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Surgical approach to intussusception in older children: Influence of lead points

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ABSTRACT

Background: The likelihood of a lead point as the cause of ileocolic intussusception increases as children get older. This study looks at whether a different management strategy should be employed in older patients.
Methods: 7 year multi-institutional retrospective study of intussusception in patients aged <12 years.
Results: Ileocolic intussusception with complete data was found in 153 patients: 109 0–2 years, 34 3–5 years, and 10 6–12 years, respectively. Bloody stools occurred in 42/143 of 0–5 years and 0/10 of 6–12 years, $p < 0.001$. Combined hydrostatic and/or surgical reduction was successful in 113/143 0–5 year olds vs 5/10 6–12 year olds, $p < 0.001$. Enemas were safe but reduced only 1 patient over age 5. Resections were required in 29 patients (15 idiopathic, 14 lead points). Lead points were found in 4/109 children under 3 years, in 5/34 aged 3–5 years and 5/10 aged 6–12 years ($p = 0.04$ vs 3–5 years and $p < 0.001$ vs 0–5 years). Lead points consisted of 7 Meckel's diverticula and 7 others.
Conclusion: Children older than 5 years are much more likely to have a pathologic lead point and early surgical intervention should be considered. In this study, enema reduction was safe but minimally beneficial in this age group.

Younger children (aged 0–2 years) with intussusception usually do not have a pathological lead point. In these cases, resection of the involved intestinal segment is not necessary, provided that the intussusception can be completely reduced, either radiologically or surgically. The management of intussusception in these younger children is well established and begins with either hydrostatic or air reduction, sometimes under ultrasound guidance. Ultrasound Doppler studies are also used to determine the presence or absence of blood flow in the intussusceptum and guide the aggressiveness of the reduction [1,2]. In many studies, the success rate with this approach is very high with the majority of patients avoiding the need for laparoscopy or laparotomy to complete the reduction [1–3]. In the occasional patient where the intussusception cannot be reduced, resection is required. The usual findings are necrosis due to prolonged vascular compression, rather than a true pathological lead point.

Increasing age is associated with a higher likelihood of finding a pathological lead point. In adult patients, pathological lead points are an expected finding among patients with intussusception. The question is: Is there an age at which the presence of a pathological lead point becomes so common that surgery is the best first step? A classic pediatric surgical textbook states that hydrostatic reduction should be attempted in all patients regardless of age [4]. It was standard training in the senior authors' institution to perform surgery on all pediatric patients with intussusception older than 2 years of age. Similarly, Van der Laan et al. found that all patients older than 2 years of age with intussusception required laparotomy with the majority requiring a bowel resection [5].

This study was performed to determine the characteristics of older children (3–12 years old) with ileocolic intussusception, to determine the incidence of pathological lead points and most importantly, to determine how to best manage these patients.

1. Materials and methods

Hospital records from six regional hospitals within a single healthcare system were searched using the diagnosis code 'intussusception.' Electronic medical records of all patients with this diagnosis from January 2007 to December 2013 were reviewed. Patients aged greater than 12 years were excluded, because it was felt that they would share the same characteristics as adult patients with respect to this diagnosis. Hospital charts were reviewed by three individuals. Only cases with a diagnosis of ileocolic intussusception were included in the study. The following data were extracted from electronic medical records: demographics, date of birth, age at diagnosis of intussusception, symptoms at presentation (emesis, grossly bloody stool, fever), length of symptoms, and date of last follow up. Fever was defined as oral or rectal temperature greater than 100.6 °F. Radiology reports were reviewed for the following information: date of contrast enema, number of contrast enema studies, presence of radiologic lead point, level of

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intussusception at start of enema, level of intussusception at end of enema and date(s) of repeat enema(s). Operative notes were reviewed for the following: type of operation (laparoscopic, laparoscopic converted to open, open), presence of pathological lead point, reduction of intussusception and resection. Pathology reports were reviewed for all findings including the location and presence of any pathology which served as the lead point for the intussusception. We defined pathological lead point as the finding of a pathologic abnormality in the resected specimen which served as the lead point for the intussusception. The finding of ischemia and/or necrosis without a co-existing lead point was not considered a pathological lead point. Cases involving small bowel-small bowel intussusception ($n = 10$) and patients who had no follow up and/or had insufficient hospital records were excluded ($n = 12$). Patients were grouped into the following age categories: 0, 1, 2, 3, 4, 5, 6–12 years old before statistical analyses were performed.

The general radiological approach was to use the hydrostatic enema with the bag 3 feet above the level of the rectum, infusing water soluble contrast up to 3 min at a time or until no further reduction was evident. In most cases the colon was drained and the infusion was repeated up to three additional times until no further progress was made.

Analyses of length of symptoms, presence of emesis, bloody stools, fever at diagnosis, hydrostatic enema reduction attempts, hydrostatic enema reductions, surgical reductions, surgical resections and presence of pathological lead points were performed based on age groups. Using GraphPad QuickCalcs Software (©2014, GraphPad Software, Inc, La Jolla, CA), the statistical significance of differences between age groups 0–5 and 6–12 years was calculated. Fisher's exact test was used for categorical data and student's t test was used for continuous data. A 5% level of significance was used for all cases. The study was approved by our regional institutional review board, approval number 10251.

2. Results

A total of 153 cases of ileocolic intussusception were identified among the ages of 0–12 years from January, 2007 to December, 2013. Of these patients, 55 were age <12 months, 37 were age 1 year, 17 were age 2 years, 34 were age 3–5 years and 10 were age 6–12 years (Table 1). Examination of the data revealed a natural break between ages 5 and 6 years, rather than an anticipated break between ages 2 and 3 years. For this reason, comparisons were made between groups aged 0–5 years and 6–12 years, respectively. Average length of symptoms for the different age groups was 1.9, 2.1, 2.4, 2.2 and 3.3 days, respectively. There was a significant difference in length of symptoms between children of age 6–12 (3.3 days) and 0–5 (2.1 days, $p < 0.001$). In children aged 0–5 years, 56% presented with emesis whereas only 40% presented with emesis in children aged 6–12 years ($p < 0.001$). Similarly, 29% of children aged 0–5 years presented with bloody stools whereas none of the children aged 6–12 years presented with bloody stools ($p < 0.001$). Only 9% of patients aged 0–5 presented with fever whereas 30% of patients aged 6–12 years had a fever upon diagnosis ($p < 0.001$).

In many cases, the patient's initial presentation was to the emergency department. If the diagnosis of intussusception was not suspected clinically, the emergency department physician may have ordered an abdominal CT scan. In other cases, where the diagnosis of intussusception was suspected, an ultrasound or a contrast enema was obtained as the initial study. When intussusception was diagnosed by CT scan, the attending surgeon made a decision on whether to proceed with an attempt at hydrostatic reduction or proceed with surgical intervention. If this study suggested a small bowel to small bowel intussusception the patient may have been taken to surgery without an attempt at enema reduction. In some cases, primarily early in the study period, the lack of an experienced radiologist may have prompted the surgeon to proceed directly to the operating room, rather than attempt a hydrostatic reduction. This was more likely to be true in older patients. Of the 153 patients with intussusception, contrast enema reduction was attempted 168 times in 130 patients and successfully reduced the intussusception in 67 patients (Table 2).There were 6 patients in whom a CT scan showed ileocolic intussusception but the intussusception was spontaneously reduced by the time the patient underwent a contrast enema or surgical exploration. These cases were counted as spontaneous reductions. There were also 10 patients in whom the CT scan showed small bowel to small bowel intussusception (6 reduced spontaneously, 3 underwent open or laparoscopic reduction, and one patient with Peutz–Jegher's syndrome underwent resection of a polyp that had served as the lead point). These patients were excluded from the overall analysis. The number of delayed repeated enemas ranged from 0 to 2 times per patient. A total of 80 patients underwent laparoscopic or open surgical intervention. Of the surgical cases, 51 were reduced intraoperatively whereas 29 intestinal resections were performed. Changes consistent with ischemia and necrosis were seen in 15 patients, none of which had a pathological lead point, and all of whom were less than three years of age. 14 patients had a pathological lead point. Specifically among the patients aged 6 and above, 10 patients were diagnosed with ileocolic intussusception. Hydrostatic reduction was attempted in four patients and was successful in one. The other 3 went to the operating room, one was reduced and the other two underwent resection of a pathological lead point. It was the surgeon's choice to take the other 6 patients directly to the operating room, without attempting hydrostatic reduction. Of these 6 patients who went to the operating room, one had reduced spontaneously, two were reduced surgically without discovering a pathological lead point and the remaining 3 had lead points removed. Pathological lead points were found in 9/143 (6%) of children aged 5 and younger and in 5/10 (50%) of children aged 6–12 years ($p < 0.001$).

The pathologic findings in the patients with lead points are shown in Table 3. Of the patients aged 6–12 years, the lead points included 2 patients with Meckel's diverticulum, 1 patient with a metastasis from a Ewing's sarcoma primary, 1 patient with appendiceal mass and cystic fibrosis and 1 patient with a hyperplastic mesenteric lymph node, which served as the lead point. In patients aged 3–5 years, 11 patients were taken to the operating room. Lead points were present in 5 patients and 5 patients were reduced intraoperatively. The remaining intussusception reduced spontaneously. Of the 8 patients aged 2 years who were taken to the operating room, one had a pathologic lead point. All 3 of the resected specimens had pathologic findings consistent with

Table 1
Patient characteristics.

			Emesis		Bloody stools		Fever	
Age (years)	N	Average days of Symptoms (mean ± SD)	Number	Percent	Number	Percent	Number	Percent
0	55	1.9 ± 1.1	45	82	29	53	6	11
1	37	2.1 ± 1.5	24	65	12	32	6	16
2	17	2.4 ± 1.5	11	65	1	6	1	6
3–5	34	2.2 ± 1.5	20	59	6	18	7	21
Total 0–5	143	2.1 ± 0.2*	80	56*	42	29*	13	9*
6–12	10	3.3 ± 2.2*	4	40*	0	0*	3	30*
Total	153	2.1 ± 1.2	180		90		33	

* $p < 0.001$ for 6–12 vs 0–5.